Printed Pages : 7 **TME – 201**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4039 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. II) EXAMINATION, 2007-08

MECHANICAL ENGINEERING

Time : 3 Hours] *[Total Marks : 100*

Note : *(1) Answer **all** questions.*

*(2) Use of steam **table** and Mollier's chart is permitted.*

*(3) Assume missing **data suitably** if any.*

1 Attempt any **four** parts of the following : **4×5=20**

(a) Explain with examples, what are microscopic and macroscopic point of views to study the subject ot thermadynamics.

(b) How will you define temperature? A metal block of 5 kg and temperature 200°C is submerged into water whose mass is 8 kg and temperature is 30°C. If the specific heat of metal is 0.2 kJ/kgK, what will be the final temperature of the system?

(c) Air during a reversible process is compressed from initial pressure 12 kN/m^2 to 6 times the

initial pressure. Due to this compression volume of air decreases from initial volume 4 m^3 to 1.8 m^3.

Calculate:

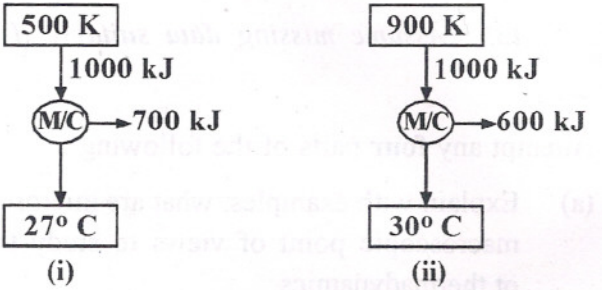
(i) Law of the process

(ii) Work done in compressing the air

(d) Two carnot refrigerators A and B are arranged in series. Obtain the COP of thin composit system in terms of COP of refrigerator A and B only.

(e) What is Carnot theorems? What are its different corrolaries? Explain.

(f) Block diagrams of two systems are given below : Giving proper reasons indicate



(i) Name of the system (i.e. HE, RE or HP)

(ii) Type of cycle is possible or impossible and reversible or inversible.

2 Attempt any **two** parts : **10×2=20**

(a) (i) What are different types of IC engine? Why the compression ratio in a CI engine is greater than that for a SI engine, explain?

(ii) Sketch a Carnot cycle for water-steam system. Why is Carnot cycle not used as thermodynamic cycle for the steam power plant?

(b) In a steam power plant, steam is supplied to the turbine at 36 bar and 410°C. The condenser pressure is 0.075 bar. If the turbine develops a power of 12 MW calculate for a theoretical cycle :

(i) Mass flow rate of steam

(ii) Heat addition and heat rejection

(iii) Pump work

(iv) Thermal efficiency

(c) For a diesel cycle following data were observed.

Air inlet pronax and temperature = 1.01 bar and 300 k

Compression ratio = 20

Cut off ratio = 2

Calculate the temperatures at all points of the cycle, net power output and thermal efficiency of the cycle.

3 Attempt any **two** of the following : **10×2=20**

(a) Explain the following :

(i) General condition of equilibrium of a system of coplanar concurrent forces.

(ii) Moment of a couple. Show that a force acting at a point is equivalent to a force - couple system at another point.

(iii) Laws of dry friction.

(iv) Belt friction and its applications.

(b) Forces 7,1,1and 3 kN act at one of the angular points of a regular pentagon towards four other angular points taken in order. Obtain the resultant of this force system. What is its direction?

(c) A block of stone weighing 50 kN rests on a horizontal floor. If the coefficient of friction between floor and block is 0.3 and if a man pulls the block through a string which makes an angle α with the horizontal, find for what value of the force necessary to move the block will be minimum. Find this force also.

4 Attempt any **two** parts of the following : **10×2=20**

(a) (i) Define a beam. Explain how shear force and bending moments are developed at different sections of the beam.

(ii) How are the trusses classified? What are the assumptions taken while analysing a plane truss ?

(b) Determine the forces and their nature in each member of the truss loaded as shown in **Fig 1**.

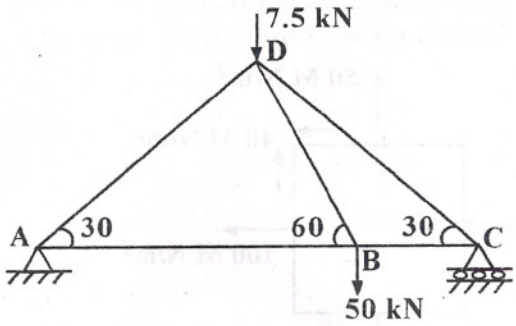


Fig. 1

(c) Draw the shear force and bending moment diagrams for the beam shown in **figure 2**.

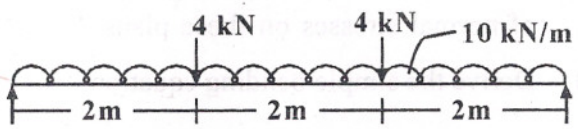


Fig. 2

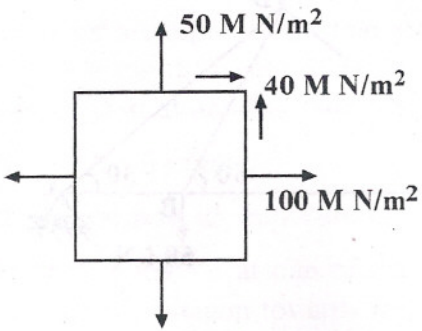
5 Attempt any **four** parts of the following : **5×4=20**

(a) Draw stress-strain diagram for a ductile material and define different points shown on it.

(b) A round bar 40 cm long has 5 cm diameter for middle half of its length and a reduced diameter at the two ends (ends are equal in diameter and length-wise). Bar carries axial load of 10 kN. Find the diameter and end section if the total allowable extension is 0.03 cm

$E = 200\ GN/m^2$.

(c) Calculate the value of principal stresses and the planes on which they occur for the stresses shown in **Figure 3**.



Also caluclate the plane on which maximum shear stresses are occurring. What are the values of normal stresses on these plans ?

(d) Derive the simple bending equation.

$$\frac{N}{I} = \frac{T_b}{Y} = \frac{E}{R}.$$

Also mention the assumptions made in the derivation.

(e) Determine the dimensions of a rectangular Simply supported steel beam 5 m long to carry an UDL of 10 kN/m, if the maximum permissible bending stress is 1000 N/cm^2. The depth of the beam is 1.5 times its width.

(f) Design a circular solid staff to transmit 80 kW power at 200 rpm, if the twist in the shaft is not to exceed 2^{o} in 3m length of the shaft and maximum shear stress is limited to 70 MN/m^2. Take mod. of rigidity G = 90 GN/m^2.
